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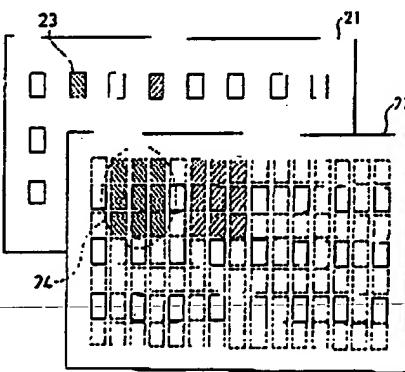
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## (54) Image display device with backlighting

(57) An image display device based on liquid crystal panels is arranged for outputting a high quality image, specifically one in which the problem of the shadow border between pixels has been remedied. Embodiments of the display device employ various techniques to address the problem. One solution, a multi-pixelating technique, surrounds pixels with virtual images of pixel, where both the spacing and the range of the multi-pixelating are precisely controllable. In other solution, the divergence of the light incident upon the liquid crystal panel is carefully controlled, or the light field emerging from the liquid crystal panel is modulated, in order to project a carefully controlled pixel image intensity distribution onto a diffusely scattering surface. The techniques developed are applicable to color liquid crystal panels as well, and can be employed to perform a precisely interpolated-color mixing of neighboring pixels. Some of the embodiments employ a specially designed lighting unit for providing white parallel rays to the liquid crystal device. Because of advantages in areas of size, weight and image quality, the display device is particularly suitable to head mounted displays.

Fig. 2



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## EUROPEAN SEARCH REPORT

Application Number  
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DOCUMENTS CONSIDERED TO BE RELEVANT			(CLASSIFICATION OF THE APPLICATION (BLC(LS))
Category	Description of document with indication, where appropriate, of relevant passages	Relevant to claims	
X	EP-A-0 509 630 (DOIGOFF EUGENE) 21 October 1992 * the whole document *	1-5,14. 43,44	G02B27/00 G02F1/13.05 G02B21/01 H04N5/72 H04N9/31
X	EP-A-0 492 661 (SANYO ELECTRIC CO) 1 July 1992 * the whole document *	1,2,14, 43,44	
X	US-A-5 005 968 (TEJIMA YASUYUKI ET AL) 9 April 1991 * the whole document *	1,2,14, 43,44	
X	US-A-4 587 553 (WATANABE TOSHIRO ET AL) 6 May 1986 * the whole document *	1,2,14, 43,44	
X	FR-A-2 611 389 (THOMSON CSF) 2 September 1988 * the whole document *	1,2,14. 43,44	
X	EP-A-0 133 440 (SONY CORP) 27 February 1985 * the whole document *	1,14 43,44	TECHNICAL FIELDS SEARCHED (See 7.1)
A			G02B H04N G02F
D.A.	WO-A-92 16075 (DURAND LTD :JOHNSON WILLIAM N H (GB)) 17 September 1992 * the whole document *	1-3,14. 15,43,44	

Date of search	Date of completion of the search	Name
THE HAGUE	28 March 1996	WARD, S

CATEGORY OF OTHER DOCUMENTS	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document in the same category A : technological background C : non written disclosure P : intermediate document	
T : theory or principle underlying the invention E : earliest patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons G : member of the same patent family, corresponding document	

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The present European patent application comprised at the time of filing more than ten claims.

- All claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for all claims.
- Only part of the claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claims:
- No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

**LACK OF UNITY OF INVENTION**

The Examining Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions.  
namely:

see sheet R

- All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid.

namely claims:

- None of the further search fees has been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions mentioned in the claims.

namely claims: 1-9, 43, 44 and 14-15 (depending on 1-9)

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## LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions, namely:

1. **Claims 1-9,43,44 and 14-15 (depending on 1-9) :**  
Image display device incorporating pixel multiplying means.
2. **Claims 10-13,16-27 and 14 (depending on 10-13) and 15 (depending on 10-14) :**  
LCD image display device incorporating lighting means and fine refracting means.
3. **Claims 28-32,48 :**  
LCD backlighting means incorporating white point light source, refracting means, optical fibre and converting means
4. **Claims 33-42 :**  
Colour mixing display device comprising divergence control type lighting means, filter, light valve and back projection screen.
5. **Claim 45 :**  
Display device incorporating matrix of picture elements and an optical system comprising respective waveguide means for each picture element such that said optical system produces a local distribution of the light from each picture element.

Claim 44 is a broad claim which can be said to contain the material of claim 1 and of claim 45. The several X documents for claim 44 thus imply the status of lack of unity a posteriori for claim 45 with respect to claim 1.